Advanced Air Vehicles

Efficient Manufacturing Process Development

Completed Technology Project (2014 - 2020)

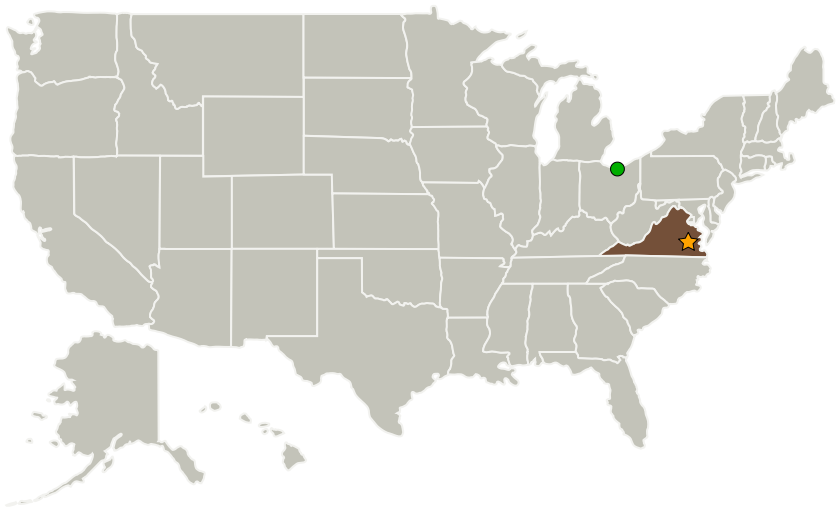
Project Introduction

The Efficient Manufacturing Process Development challenge develops and demonstrates new computational methods to relate manufacturing parameters to defect formation, and a connection to commercial design and analysis software allowing structural optimization while resolving predicted manufacturing issues.

Anticipated Benefits

This technical challenge addresses the ability to reduce manufacturing development time by reducing the number of iterations and by better predicting and addressing quality issues. It enables more control of processes that can streamline product certification, and increases accountabililty for manufacturing constraints improving preliminary designs reducing the likelihood of rework.

Primary U.S. Work Locations and Key Partners



Efficient Manufacturing Process Development

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Completed Technology Project (2014 - 2020)

Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Aurora Flight Sciences Corporation	Supporting Organization	Industry	Cambridge, Massachusetts
Collier Research & Development Corporation	Supporting Organization	Industry	Hampton, Virginia
Convergent Manufacturing Technologies US	Supporting Organization	Industry	Seattle, Washington
General Electric Company	Supporting Organization	Industry	Niskayuna, New York
●Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
McNAIR	Supporting Organization	Industry	
National Institute of Aerospace	Supporting Organization	Academia	Hampton, Virginia
Northrop Grumman Aerospace Systems(NGAS)	Supporting Organization	Industry	Redondo Beach, California
The Boeing Company(Boeing)	Supporting Organization	Industry	Chicago, Illinois
United Technologies Corporation	Supporting Organization	Industry	Farmington, Connecticut
UTC Aerospace Systems(UTAS)	Supporting Organization	Industry	Connecticut

Organizational Responsibility

Responsible Mission Directorate:

Aeronautics Research Mission Directorate (ARMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Advanced Air Vehicles

Project Management

Program Director:

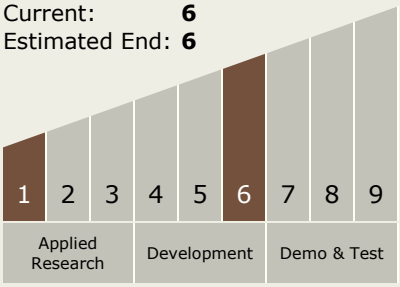
James A Kenyon

Project Manager:

Richard D Young

Technology Maturity (TRL)

Start: **1**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

Continued on following page.

Efficient Manufacturing Process Development

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Primary U.S. Work Locations
Virginia

Project Transitions

October 2014: Project Start

September 2020: Closed out

Closeout Summary: Automated Fiber Placement (AFP) Defects Process Model: Developed and delivered a physics-based model to predict pre-preg tack and simulate the AFP process at the roller contact point. Model includes quantified tack force as a function of process parameters, ply geometry exported from path simulation software, and quantified resin pressure. Model was demonstrated to predict trends observed for relationship between process parameters, part geometry, and out-of-plane defects the formed. Process Models Validation & DFM Software Complete: DFM software suite (e.g., HyperSizer, Central Optimizer, CAPP Module, Vericut Composite Programming, and process models) were evaluated. Team Members completed the functional checkout of the DFM tools using company-specific composite panel designs and provided feedback to DFM and process model developers. Each software package was updated based on Member feedback. Design for Manufacturing (DFM) Software Validated: the DFM central optimizer and the Computere Aided Process Planner (CAPP) module were updated based on team member evaluations. Updated software includes: Optimization with AFP fiber directions and laps/gaps; automated re-sizing the laminates to resolve negative margins caused by the presence of AFP features by applying "sizing knockdowns" generated from importing and analyzing AFP data.

Project Website:

https://www.nasa.gov/aeroresearch/programs/aavp/ac

Technology Areas *(cont.)*

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.2 Intelligent Integrated Manufacturing

Target Destination

Earth